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ABSTRACT

This paper analyzes the determinants of literacy and earnings in Ghana. Introductory sections discuss developments in literacy in the United States and Great Britain, literacy rates in developing countries, worldwide increases in literacy, literature on the determinants of literacy, aspects of the Ghanaian economy and educational spending, and the human capital framework for analyzing the relationship between education as investment and income as return on investment. Analysis of two household surveys in Ghana found that literacy and age were negatively correlated, suggesting that efforts in recent years to expand and improve basic education programs have been successful in raising adult literacy rates. Females were less literate than males, controlling for other factors. Literacy was positively associated with parents' education and negatively related to distance to the nearest primary school, residence in a rural area, and poverty. Income was related to age and male gender, but not to education. Functional literacy appears to be a prerequisite for entering the labor market, which may partly explain the lack of return to education other than middle school and technical/professional training. Basic education and literacy programs should target females and poorer households, especially in rural areas. (Contains 22 references.) (SV)

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Abstract

This article analyzes the determinants of literacy and earnings in Ghana. It links literacy and earnings with a variety of factors, including age, gender, family educational background, distance to school, and income. Literacy and age are negatively correlated, suggesting that efforts at strengthening the supply and quality of basic education programs in recent years have been successful in raising literacy rates. Females are less literate than males, controlling for other factors. Parents' education is positively associated with literacy. Distance to the nearest primary school, residency in a rural area, and poverty affect literacy negatively. Functional literacy appears to be a prerequisite for entering the labor market, which may partly explain the lack of return to education other than middle school and technical/professional training. The policy implication of the study is that basic education and literacy programs should target females and poorer households, especially in rural areas.

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1. INTRODUCTION

Significant and rapid increases in earnings and education have taken place over the past hundred years in industrial economies. In developing economies the picture is different: High illiteracy rates and very low incomes, and thus widespread poverty, are realities for large parts of the world. Literacy and income are closely linked. Establishing and assessing the nature of these links may help increase both literacy rates and earnings, thereby eradicating poverty.

In this article, we analyze the determinants of literacy and earnings in Ghana based on two household surveys. Our results link literacy and earnings with a variety of factors, including age, gender, family educational background, distance to school, and income. Literacy and age are found to be inversely correlated, implying that younger generations are more literate than older generations. This relationship indicates that recent efforts to strengthen the supply and quality of basic education programs have been successful. Females are found to be less literate than males, controlling for other factors. Parents' education is positively correlated with their children's literacy. Distance to the nearest primary school and residency in a rural area, are negatively correlated with literacy rates. Poverty and literacy are also negatively correlated.

Our analysis of the determinants of earnings reveals no significant returns to education other than middle school and technical/professional training. This result may indicate that the quality of education in Ghana generally is poor. Alternatively, it could suggest that education is not serving as a signaling device in Ghana.

Functional literacy affects selection into the labor market. In developing countries, jobs are rationed (that is, demand-side determined). We therefore interpret this result to indicate that functional literacy is a prerequisite for entering the labor market. This interpretation may partly explain the lack of returns to education.

The policy implications of these results are that greater efforts should be devoted to developing functional literacy skills and basic education. Policymakers should aim to increase both the supply and the quality of basic education and literacy programs. Basic education and literacy programs should target females and poorer households, especially in rural areas.

The article is organized as follows. Section 2 describes changes in and determinants of literacy. Section 3 describes the Ghanaian economy. Section 4 presents the economic model and the econometric methodology underlying the analysis. Section 5 presents the data and descriptive statistics, and section 6 presents the regression analysis. Section 7 summarizes the article's findings and draws policy conclusions.

2. CHANGES IN AND DETERMINANTS OF LITERACY

Opinions differ widely over how best to define literacy. Unesco defines a functionally literate person as any person 15 or older who can "read and write a simple statement on his or her everyday life" (Unesco 1993, p. 24). The *World Development Report* (1997) also adopts this definition of functional literacy. Others propose a broader and more explicitly political definition. Paulo Friere, the Brazilian educator, sees literacy as a process of "conscientization" that involves "reading the world" rather than merely "reading the word" (Friere and Macedo 1987).

Widespread literacy is a twentieth century phenomenon. Before the nineteenth century, when public school systems were developed, education was reserved for the few. School systems developed in industrial countries largely in response to increased and more specialized industrialization, which in turn lead to increased economic growth and demand for an even more educated laborforce.

Over the past decade, education worldwide has exploded, as a result of the ever-increasing demand for still more specialized labor. Attitudes toward education have also shifted. Less than 50 years ago, education, especially higher education, was reserved

largely for men. Today people in industrial countries believe the entire population has the right to education.

2.1 Developments in Literacy in the United States

Literacy progressed in stages in the United States. Initially, according to Haas (1996), literacy spread because radical Protestants wanted to read the Bible. Their need for literacy lead to agitation for general public education in the nineteenth century. Literacy rates later rose as a result of several societal changes, beginning with Reconstruction (Coy 1988). Immigration during the Industrial Revolution and the Progressive reform movement increased literacy later in the nineteenth and early twentieth centuries. World War I and the Depression forced the federal government into a more active and direct role, and literacy rose even farther. The civil rights movement of the 1960s shifted the focus to minority groups, broadening efforts to fight illiteracy. Coy believes that the concept of functional literacy developed during this period and that the formalization of that concept helped increase the number of adult literacy programs.

2.2 Developments in Literacy in Great Britain

In Great Britain literacy also progressed in stages. Street (1995) identifies three distinct stages in the modern development of adult literacy programs. First, the recognition of adult illiteracy being a widespread phenomenon - in the 1960s - lead to increased focus on the issue. Government grants were provided, a national "Right to Read Campaign" was launched, and local practice and experience was developed. During the 1970s and early 1980s the government-funded agency Adult Literacy and Basic Skills Unit emerged. The unit provided materials and guidelines for good practice and funded small research projects. Since the late 1980s there has been a shift in policy and focus, aiming at adjusting education toward changing national and economic needs.

2.3 Rates of Literacy in Developing Countries

Substantial regional differences in illiteracy rates exist. The rate of illiteracy is relatively low in Latin America and the Caribbean (13.4) and very high in South Asia (50.6 percent) (table 1). Ghana is in the middle of the spectrum, with an illiteracy rate of 35.5 percent. Regions with high illiteracy rates also tend to have low per capita GNP and high pupil-teacher ratio. Within Sub-Saharan Africa, substantial differences exist between Anglophone and Francophone countries (table 2). Illiteracy rates in Anglophone countries are 16 percentage points lower than in Francophone countries. Average per capita GNP in Anglophone countries is more than twice as high as in Francophone countries, school enrollments are higher, and pupil teacher ratios are lower (37.8 pupils per teacher in Anglophone countries versus 47.3 pupils per teacher in Francophone countries).

Table 1. Selected Social and Macroeconomic Indicators, Ghana and Six Regional Groups, 1995

Indicator	*Ghana*	*East Asia and Pacific*	*Europe and Central Asia*	*Latin America and the Caribbean*	*Middle East and North Africa*	*South Asia*	*Sub-Saharan Africa*
Adult illiteracy rate (percent)	35.5	16.9	—	13.4	38.7	50.6	44.0
GNP per capita	350.0	807.8	—	3,419.8	—	354.1	485.6
Gross primary enrollment ratio (percent)	76.0	115.4	99.6	111.5	96.5	99.0	74.6
Ratio of primary school pupils to teachers	27.6	24.2	20.0	24.5	27.8	62.7	40.6

Notes: — Not available, gross primary enrollment ratio and ratio of primary school pupils to teachers for Ghana are for 1993.
Source: World Bank Edstats database.

Table 2. Selected Social and Macroeconomic Indicators, Ghana and Anglophone and Francophone Countries in Sub-Saharan Africa, 1995

Indicator	*Ghana*	*Anglophone countries in Sub-Saharan Africa*	*Francophone countries in Sub-Saharan Africa*
Adult illiteracy rate (percent)	35.5	36.1	51.9
GNP per capita	350.0	675.7	333.4
Gross enrollment ratio (percent), primary	76.0	88.8	64.4
Ratio of pupils to teachers, primary	27.6	37.8	47.3

Notes: Gross primary enrollment ratio and ratio of primary school pupils to teachers for Ghana are for 1993.
Source: World Bank Edstats database.

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2.4 Worldwide Increases in Literacy

For the world as a whole, illiteracy rates have declined significantly, falling from almost 40 percent in 1970 to just 25 percent in 1990. Rates of illiteracy fell even more dramatically in developing countries, declining from 50 percent in 1970 to 35 percent in 1990 (Lim; 1996). Wide differences across gender, geographical region, and age exist within countries, however. For the most part, males have higher literacy rates than females, urban areas have higher literacy rates than rural areas, and younger generations have higher literacy rates than older generations. Lim (1996) also draws attention to the fact that while total illiteracy rates have been falling, the proportion of women in the world's total illiterate population has been rising. Three reasons for this tendency are suggested: the technologies of goods production, the nature of human reproduction, and institutionalization of violence in the state.

2.5 Literature on the Determinants of Literacy

Little has been written on the determinants of literacy. Lavy, Spratt, and Leboucher (1995) analyze the determinants of literacy in Morocco. They find that illiteracy is more widespread among females than among males, higher in rural areas than in urban areas, and inversely correlated with age. The negative relationship between age and literacy may reflect both deteriorating literacy skills over time and improvements in the quality of education. Lavy, Spratt, and Leboucher also find that parents' literacy and household expenditure level positively affect the level of children's literacy, suggesting that poverty and family background are important determinants of literacy.

Verner (1999) analyzes the determinants of worldwide literacy rates by applying a human capital framework. She finds that enrollment rates, average years of schooling of adults, and life expectancy at birth are the main determinants of literacy. Income affects literacy in a nonlinear fashion, with a negative impact until a threshold of about $2,000 income per year per capita, after which the effect is positive. Institutional and regional variables are not very important in explaining literacy across countries. Literacy rates differ widely across regions, a finding that can be explained by social and economic conditions.

3. AN OVERVIEW OF THE GHANAIAN ECONOMY

Ghana is a low-income country, with per capita income of $406 in 1998 (World Bank 1999a). It relies heavily on the agricultural sector, in particular cocoa, which accounts for almost half of GDP (World Bank 1999b).

From the mid-1970s to the mid-1980s, declining cocoa production and trade restrictions stalled economic growth in Ghana. The return of more than a million Ghanaians from Nigeria in 1982-83 and a prolonged drought in 1982 caused growth rates to fall to all-time low levels by about 1984.

In conjunction with the IMF and the World Bank, the Ghanaian government initiated the Economic Recovery Program (ERP) in 1983. The program implemented a number of policy reforms aimed at restoring macroeconomic stability, encouraging savings and investment, providing an enabling environment for the private sector, and improving public sector management, including privatization of some of the many publicly owned enterprises.

The ERP places significant emphasis on education. The Education Sector Reform Program, established in 1987, improved the efficiency, quality, and relevance of education. The program also increased access to education and shortened the length of pre-university schooling from 17 to 12 years. As a result of the reform program, spending on education rose from 1.4 percent of GDP in 1983 to 3.8 percent of GDP in 1994.

The government's plans for additional reforms are outlined in its development strategy, "Ghana-Vision 2020" (Republic of Ghana 1995). A substantial part of the program's social agenda is aimed at basic education. Specific goals include achieving universal basic education and adult literacy, increasing access to secondary and tertiary education, and strengthening laborforce skills by increasing technical and vocational training. To achieve these goals, the government, with the assistance of the World Bank and other donors, launched the Basic Education Sector Improvement Program in 1996. The

program plans to increase investment in school facilities and teacher housing in rural areas and to strengthen science and math in the curriculum by raising education expenditures from 3.8 percent of GDP in 1998 to 4.1 percent in 2001.

4. THE ECONOMIC MODEL AND THE ECONOMETRIC FRAMEWORK

The framework for the analysis is standard human capital theory, in which individuals build up knowledge and skills through education and experience -- specific on-the-job experience as well as general experience (Becker 1975; Mincer 1974). According to the theory, individuals who invest in human capital are subsequently rewarded with higher earnings. Formally, the economic model may be derived from the theory of either household or individual demand for schooling, both of which view education as an investment in human capital. In industrial economies, in which subsidies for education are common, the investment decision may be viewed as an individual decision; in developing economies the relevant decision unit may be the household (Khandker, Lavy, and Filmer 1994; Mason and Khandker 1997). Households will invest in education up to the point at which the marginal benefit from an additional year of schooling equals the marginal cost of an additional year of schooling.[1]

In the traditional human capital literature, earnings are determined by education and other individual, household, and, possibly, community characteristics. Earnings are observed, however, only for individuals who have positive earnings (that is, who actually supply labor). To take this into account, we specify a labor supply function. Our model then becomes:

(1) $E_i = E(A_i, H_i, C_i)$

(2) $S_i = S(A_i, H_i, C_i)$

[1] This implicitly assumes that the household decisionmaker possesses perfect information and that capital markets are perfect. Both assumptions are very restrictive and appear unrealistic in developing economies.

where E_i (earnings of individual i) and S_i (the labor supply of individual i) are the dependent variables; I is a vector of individual characteristics, such as age and age squared (to capture possible nonlinearities), gender, the individual's level of education, and the level of education of the individual's parents; H is a vector of household characteristics, such as the wealth of the household; and C is a vector of community variables, such as urban versus rural location. Literacy, L_i is then determined by the following simple model:

$$L_i = L(I_i, H_i, C_i) \tag{3}$$

The explanatory variables are similar to those in the earnings equation, with some differences. In order to investigate the possible link between poverty and literacy, we include earnings and the poverty quintile of the household in H. We also include a measure of the distance to the nearest primary school in C.

To analyze the determinants of earnings, we use a Heckman selection model (1976, 1979), which can be briefly described as follows. Consider the earnings regression:

$$\ln W_i = X_i\beta + \varepsilon_i \tag{4}$$

where $\ln W_i$ is log-earnings for individual i, X_i is a vector of explanatory variables for individual i, β is a vector of parameters, and ε_i is an error term capturing unobserved variables. The problem in estimating equation 4 is that we implicitly apply a sample selection rule because we observe only earnings of individuals who work; potential earnings of people who do not supply labor are not incorporated. If the sample has characteristics that differ from those of the underlying population in a nonrandom fashion, it will suffer from a selection bias, which, if not taken into account, will lead to biased parameter estimates. Heckman's solution to this problem is to incorporate the labor supply choice in the earnings equation. The earnings and labor supply choice equations thus become:

(5) $$\ln W_i = X_i\beta + \varepsilon_i$$

(6) $$I^*_i = Z_i\gamma + \nu_i$$

where equation 5 is the earnings equation (equivalent to equation 4), I^* in equation 6 is a latent variable that reflects the excess utility from participating in the labor market, and Z_i is a vector of variables explaining the labor supply decision of individual *i*. The latent variable I^* corresponds to the indicator variable:

$$I_i = 1 \text{ if } I^*_i > 0, 0 \text{ otherwise}$$

The model is estimated by first estimating the inverse Mill's ratio and then including it as an additional regressor in equation 5:

(7) $$\ln W_i = X_i\beta + \lambda_i\mu + \varepsilon_i$$

where λ_i is an estimate of the inverse Mill's ratio for individual *i*.[2]

The Heckman model views labor supply as an individual choice. This view may be inappropriate in a development context, where the absence of (public) safety nets means that there is not likely to be much of a choice involved in the labor supply "decision." The labor actually supplied to the market is likely to be determined more from the demand side than from the supply side. This contrasts with industrial economies, in which the labor supply decision is likely to be made in a different way. Skilled workers are more likely to supply their labor than unskilled workers since they forgo more income than do skilled workers by staying idle (given that there is a social safety net whose benefits are high enough not to "force" them into working).

[2] We applied the maximum likelihood version of the Heckman selection model -- rather than the Two-Step version -- in order to be able to weight the data.

We view the Heckman model as the general model, the validity of which must be tested against the reduced model. The reduced model here is the standard earnings equation, which is nested within the selection model. That is, the standard earnings equation is a special case of the selection model in which the selection correction terms, λ_i, are statistically insignificantly different from zero.

5. THE DATA AND DESCRIPTIVE STATISTICS

We test the model using data from two household surveys, the 1991/92 Ghana Living Standards Survey (GLSS3) and the 1997 Core Welfare Indicators Questionnaire (CWIQ). GLSS3 aims at obtaining measures of the living standard in Ghana on several dimensions, including health and education/literacy. The survey is very extensive and includes 4,565 households. The CWIQ aims mainly at providing data applicable for analyzing factors affecting poverty, education, and labor markets issues. It contains a much smaller number of questions (questions about earnings, for example, are not included) but a larger sample of households (14,514) and individuals (60,686).

5.1 Results on Literacy

Investigating literacy and its covariates for the GLSS data enables differentiating between several types of literacy and reveals that being able to read and write in English is associated with higher earnings than is being able to read and write in one or more Ghanaian languages (table 3).[3] The various measures of literacy are highly correlated, however, a problem that is likely to cause collinearity in the regression analysis of the next section. To circumvent these problems, we combine the various literacy variables into a single composite measure of functional literacy. Specifically, we define individuals as functionally literate if they can read or write in English or any Ghanaian language and perform arithmetic calculations.

The results of the GLSS3 survey reveal a significant gender gap in literacy (tables 3 and 4). The rate of literacy among males (37.6 percent) is more than twice as high as among

[3] Both surveys rely on self-assessment of literacy, which puts the validity of their findings in some question. The fact that self-reports of literacy are reasonably consistent with educational levels suggests that under- or overreporting are not serious problems, however.

females (18.2 percent). In contrast, the results of the CWIQ survey do not indicate major gender-related differences in literacy. In order to rigorously establish whether systematic gender-related differences in literacy exist, we need to control for other factors that may influence literacy. This is done in the regression analysis in the next section.

Table 3. Correlations of Earnings, Literacy, and Gender

Variable	*Earnings*	*Reade*	*Readg*	*Write*	*Writg*	*Wcalc*	*Female*
Earnings	1.000						
Reade	0.215	1.000					
Readg	0.160	0.765	1.000				
Write	0.221	0.947	0.758	1.000			
Writg	0.159	0.764	0.902	0.769	1.000		
Wcalc	0.173	0.855	0.782	0.842	0.752	1.000	
Female	-0.074	-0.234	-0.223	-0.221	-0.211	-0.238	1.000

Note: Reade: 1 if individual can read in English, 0 otherwise
Readg: 1 if individual can read in (at least) one Ghanaian language, 0 otherwise
Write: 1 if individual can write in English, 0 otherwise
Writg: 1 if individual can write in (at least) one Ghanaian language, 0 otherwise
Wcalc: 1 if individual can do written calculations, 0 otherwise.
Source: Ghana Living Standards Survey 1991/92.

Table 4. Literacy Rates by Gender (percent)

Gender	Literacy rate based on GLSS3 data	Literacy rate based on CWIQ data
Female	18.20	37.74
Male	37.64	63.13
Total	25.78	49.40

Source: Ghana Living Standards Survey 1991/92; Core Welfare Indicators Questionnaire 1997.

Literacy rates also vary with age (tables 5 and 6). Older cohorts are less literate than younger cohorts, suggesting that recent efforts toward strengthening the supply and quality of basic education and literacy programs have been successful. (This relationship is further explored in the regression analysis in the next section, where we include several additional control variables.)

Table 5. Literacy Rates by Age Range (percent)

Age range	*Literacy rate*
15-20	45.30
21-25	39.91
26-30	30.28
31-35	31.66
36-40	27.84
41-45	20.31
46-50	15.49
51-55	12.39
56-60	8.54
61+	6.82
All ages	25.78

Source: Ghana Living Standards Survey 1991/92.

Table 6. Literacy Rates by Age Range (percent)

Age	*Literacy rate*
15-19	50.04
20-24	52.55
25-29	50.31
30-34	51.48
35-39	52.34
40-44	49.75
45-49	49.89
50-54	48.10
55-60	46.75
61+	41.86
All ages	49.40

Source: Core Welfare Indicators Questionnaire 1997.

Literacy varies considerably across sectors. The GLSS data indicate that government employees have the highest literacy rate (71 percent), followed by private sector (64 percent) and public enterprise (55 percent) employees (table 7). These observations are confirmed by the CWIQ data (table 8), which show that 90 percent of public sector employees are literate, followed by the public parastatal sector (86 percent), the private formal sector (83 percent) and, finally, the private informal sector (37 percent). Hence, people employed in the informal part of the economy have much lower rates of literacy than those employed in the formal part. This finding suggests that literacy is a prerequisite for employment in the formal sector (that is, a screening device). People who are illiterate are mainly employable in the informal sector, where skills such as entrepreneurship are likely to be in greater demand (or more relevant) than literacy.

Wide differences in literacy rates exist across industries, ranging from only 30 percent in agriculture to 93 percent in finance (table 9).

Table 7. Literacy Rates by Sector (percent)

Sector	*Literacy rate*
Government	71.37
Public enterprises	55.26
Private	63.76
Other	33.33
Total	65.36

Source: Ghana Living Standards Survey 1991/92.

Table 8. Literacy Rates by Sector (percent)

Sector	*Literacy rate*
Public	90.31
Private formal	83.32
Private informal	36.67
Public parastatal	85.71
Total	42.53

Source: Core Welfare Indicators Questionnaire 1997.

Table 9. Literacy Rates by Industry (percent)

Industry	*Literacy rate*
Agriculture	29.59
Mineral	92.45
Construction	70.65
Manufacturing	54.66
Transport	81.01
Wholesale	69.54
Retail	41.58
Finance	93.04
Service	74.55
Total	42.51

Source: Core Welfare Indicators Questionnaire 1997.

Literacy rates increase as poverty declines. The rate of literacy among people in the lowest quintile (29 percent) is less than half that of people in the highest quintile (73 percent) (table 10).

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Table 10. Literacy Rates by Household Earnings Quintile (percent)

Earnings quintile	*Literacy rate*
Highest	73.10
Next to highest	56.53
Middle	48.46
Next to lowest	39.07
Lowest	29.33
Total	49.40

Source: Core Welfare Indicators Questionnaire 1997.

Turning to supply side factors, the distance from the nearest primary school seems to have an adverse effect on literacy rates (table 11).

Table 11. Literacy Rates and Distance to Primary School (percent)

Distance (minutes)	*Literacy rate*
Near (<10 minutes)	56.69
10	53.06
20	46.45
30	40.10
40	28.61
50	40.43
60	23.38
Total	49.40

Source: Core Welfare Indicators Questionnaire 1997.

5.2 Results on Earnings

Earnings vary by sector (table 12). Government employees account for 59 percent of the highest earnings quintile and just 6 percent of the bottom quintile. In contrast, private sector employees accounted for just 32 percent of the highest earnings quintile and 84 percent of the bottom quintile.

Table 12. Earnings by Sector (percent of total)

Earnings quintile	*Government employees*	*Employees of public enterprises*	*Private sector employees*	*Other*
Highest	59.3	7.04	31.66	2.01
Next to highest	52.29	6.42	38.07	3.21
Middle	29.46	10.71	54.46	5.36
Next to lowest	17.14	2.86	71.43	8.57
Lowest	6.25	3.12	84.38	6.25
All quintiles	45.81	7.05	43.46	3.69

Source: Ghana Living Standards Survey 1991//92.

Functional literacy is also correlated with earnings. Almost 60 percent of people in the highest earnings quintile in the GLSS3 and just 14 percent of people in the lowest earnings quintile are literate (table 13).

Table 13. Functional Literacy and Earnings (percent)

Earnings quintile	*Literacy rate*
Highest	58.59
Next highest	47.37
Middle	34.78
Next to lowest	32.73
Lowest	13.55
Total	36.16

Source: Ghana Living Standards Survey 1991/92.

Income distribution differs for men and women. Women account for larger shares of the lower and middle earnings quintiles, while men dominate the upper income levels (table 14).

Table 14. Earnings by Gender (percent)

Earnings quintile	*Men*	*Women*
Highest	52.74	47.26
Next to highest	53.55	46.45
Middle	46.40	53.60
Next to lowest	43.62	56.38
Lowest	33.8	66.2
All quintiles	45.98	54.02

Source: Ghana Living Standards Survey 1991/92.

Earnings are correlated with age (table 15). The trend reflects the increase in experience that takes place over the life cycle.

Table 15. Earnings by Age Range (percent)

Earnings quintile	*15-20*	*21-25*	*26-30*	*31-35*	*36-40*	*41-45*	*46-50*	*51-55*	*56-60*	*61-99*
Highest	2.86	5.49	12.89	16.71	16.47	15.27	11.22	9.79	4.3	5.01
Next highest	1.9	6.4	15.17	20.38	13.51	14.69	11.37	6.64	5.21	4.74
Middle	4.64	10.44	18.56	15.31	13.69	8.82	7.42	6.73	5.8	8.58
Next to lowest	5.34	11.37	16.01	13.69	11.14	7.89	10.44	6.96	5.57	11.6
Lowest	7.75	12.91	11.74	10.09	10.56	9.62	7.28	7.98	5.16	16.9
All ages	4.51	9.35	14.89	15.22	13.06	11.23	9.53	7.61	5.21	9.39

Source: Ghana Living Standards Survey 1991/92

People with higher levels of education dominate the higher earnings quintiles (table 16). University graduates, for example, represent less than 2 percent of the entire sample but account for more than 5 percent of the top income quintile.

Table 16. Earnings by Level of Education

Earnings quintile	*Primary school or less*	*Middle school*	*Vocational training*	*Teacher training*	*A- or O-level*	*Technical or profes-sional*	*University (B.A., M.A., Ph.D.)*	*Other*
Highest	20.18	40.36	2.41	4.82	21.08	5.42	5.41	0.30
Next to highest	20.00	50.94	6.88	4.36	15.94	1.25	0.94	0.00
Middle	31.44	54.18	2.68	1.00	8.36	1.00	1.00	0.33
Next to lowest	46.97	46.21	1.89	0.76	3.41	0.38	0.38	0.00
Lowest	52.28	41.12	2.54	0.00	3.05	0.51	0.00	0.51
All quintiles	32.01	46.88	3.40	2.41	11.40	1.91	1.76	0.21

Source: Ghana Living Standards Survey 1991/92

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6. DETERMINANTS OF FUNCTIONAL LITERACY AND EARNINGS IN GHANA[4]

To analyze the determinants of literacy, we performed multivariate regression analysis using a probit regression model. Although the determinants of earnings have been rigorously analyzed in the empirical human capital literature, the link to functional literacy has not been addressed. Hence although our main interest is identifying the determinants of literacy, we incorporate an analysis of the determinants of earnings, focusing on the role of functional literacy.

6.1 Determinants of Functional Literacy

We regress functional literacy on the explanatory variables discussed above for individuals 15 years old and older by applying probit regression techniques. A priori we hypothesize that, following standard human capital theory, earnings positively influence the probability of being literate (note that the hypothesized *causality* runs from literacy to earnings here, even though, in a sense, all variables are endogenous in the literacy probits presented below) and that literacy and age are inversely related. Older cohorts are expected to be less literate than younger cohorts both because their literacy skills deteriorate over time and because the quality of education they received was likely to have been lower than that enjoyed by younger cohorts.

We would also expect to see gender and sectoral differences in literacy rates. We therefore control for gender and sectoral differences by including gender and sectoral variables. We also include regional differences, as individuals from urban areas are likely to be more literate than individuals from rural areas because of the greater supply of schooling in urban areas. These differences are captured by including a dummy in the regression, which takes the value of 1 for individuals from urban areas and 0 for individuals from rural areas, where urban areas are defined as localities with a 1984

[4] We use sample weights in the regression analysis in this section in order to account for the possible non-representativeness of the sample, due to the sample design. Hence, these weights remedy possible over/under representation of observations on certain variables. However, the difference between

population of more than 5,000. This specification is consistent with the specification applied in the analysis for Morocco by Lavy, Spratt, and Leboucher (1995), discussed above.

The variables are all statistically significant at the 5 percent level of significance – except the variable for private sector workers which is only borderline significant -- and have the expected signs (table 17). Age negatively affects the likelihood of being functionally literate, although the effect is small: A one-year increase in age is associated with a 1 percent decrease in the likelihood of being literate. This decline in illiteracy over time may mean that increased attention toward and supply of education and literacy programs in recent years has had a positive effect on literacy. Alternatively, it may indicate that the quality of education and literacy programs has improved.

Poverty and literacy are positively correlated: Moving up one quintile in the income distribution increases the likelihood of being literate by almost 3 percent. The result suggests that illiteracy is mainly a problem for low-income individuals. Being female decreases the likelihood of being literate by almost 30 percent, suggesting a substantial gender gap in functional literacy. Living in an urban area greatly increases the likelihood of being literate.

These results are consistent with those of Lavy, Spratt, and Leboucher (1995) for Morocco. Other results obtained here differ from their results, however. Lavy, Spratt, and Leboucher, for example, find that the effect of mothers' and fathers' education on children's literacy is similar in magnitude. Our findings show that the mothers' education increases the likelihood of a person's being literate by 15 percentage-points whereas the father's education increases it by just 10 percentage-points. This difference may reflect cultural differences between Morocco and Ghana.

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parameter estimates and their statistical significance is quite robust across the weighted and unweighted specifications.

Table 17. Determinants of Adult Functional Literacy Using GLSS3 Data

Variable	*Coefficient*	*Standard error*	*Z*	*P>|z|*
Age	-0.011	0.001	-8.63	0.000
Female	-0.298	0.037	-8.04	0.000
Government worker	0.391	0.064	5.80	0.000
Public sector worker	0.301	0.108	2.78	0.005
Private sector worker	0.118	0.064	1.91	0.056
Mother's education	0.146	0.052	2.86	0.004
Father's education	0.101	0.027	3.84	0.000
Earnings quintile	0.027	0.013	2.08	0.038
Urban	0.128	0.036	3.58	0.000
Observed probability	0.345			
Predicted probability	0.309			

Note: Number of observations = 1,123, Wald $\chi^2(9) = 277.75$, Prob > $\chi^2 = 0.000$, Log likelihood = -485.192, Pseudo $R^2 = 0.34$, Coefficients are changes in the probability of an infinitesimal change for continuous variables and the discrete change in the probability for dummy variables. *z* and *P>|z|* are the test of the underlying coefficient being zero. The sectoral reference category is "other."
Source: Ghana Living Standards Survey 1991/92

We also control for sectoral occupation, something that Lavy, Spratt, and Leboucher do not do. As might be expected, working for the government affects the likelihood of an individual being functionally literate the most, at almost 40 percent, followed by working for public enterprises (30 percent) and private enterprises (12 percent). The requirements for functional literacy skills are highest for government positions, followed by positions at public enterprises and positions in the private sector.

We analyze the CWIQ data set in much the same way. As a surrogate for income, which is not measured directly in the CWIQ, we use a poverty measure based on the wealth quintile of the household in the overall distribution. We weight households according to various predictors of poverty, such as how often a household consumes meat, whether the household uses toothpaste, and so forth (Fofack 1998). With this data set we also look at distance to school, as measured in minutes.

In accordance with the previous results, the results reveal the existence of a gender gap, in which the likelihood of a female being literate is 25 percent lower than that of males (table 18). Age and literacy are inversely related, with literacy decreasing by a modest 0.4 percent a year.

Private formal and informal sector employees tend to be less literate (a negative effect of 17 and 41 percent, respectively) than the reference category of public sector employees. This result supports our previous results and suggests that the skills required by the private sector, and in particular the informal part of the private sector, differ from those required by the public sector. Workers from all industries tend to be more literate, and with different magnitudes, relative to agriculture, forestry, and fishing (the reference category). This result should be interpreted as indicating that skills requirements vary across industries.

Table 18. Determinants of Adult Literacy Using CWIQ Data

Variable	*Coefficient*	*Standard error*	*Z*	*P>|z|*
Female	-0.245	0.013	-18.43	0.000
Age	-0.004	0.000	-10.24	0.000
Private, formal	-0.170	0.023	-6.61	0.000
Private, informal	-0.412	0.018	-19.18	0.000
Parastatal/Semi-public	-0.028	0.080	-0.35	0.727
Minerals	0.380	0.061	4.97	0.000
Construction	0.113	0.026	4.33	0.000
Manufacturing	0.140	0.020	6.89	0.000
Transportation & communication	0.195	0.028	6.85	0.000
Wholesale	0.125	0.065	1.93	0.054
Retail	0.092	0.015	6.33	0.000
Finance	0.390	0.061	5.06	0.000
Service	0.158	0.016	9.98	0.000
Distance to school (in minutes)	-0.041	0.003	-12.69	0.000
Poverty quintile	0.100	0.004	23.62	0.000
Urban	0.143	0.010	13.81	
Observed probability	0.410			
Predicted probability (evaluated at the mean)	0.400			

Note: Number of observations = 30,438, Wald $\chi^2(15) = 2327.8661$, Prob > $\chi^2 = 0.000$, Log likelihood = -15820.678, Pseudo $R^2 = 0.23$, Coefficients are changes in the probability for an infinitesimal change for continuous variables and the discrete change in the probability for dummy variables. *z* and *P>|z|* are the test of the underlying coefficient being zero. The industry reference category is agriculture, forestry, and fishing. The sectoral reference category is private, informal
Source: Core Welfare Indicators Questionnaire 1997.

The distance to the nearest primary school is negatively associated with literacy, with a 10-minute increase in the time it takes to reach the school associated with a 4 percent decline in the rate of literacy. Although the impact is relatively modest, the result points

to the importance of increasing the supply of primary schooling. Individuals from urban communities are found to be more literate than individuals from rural areas and, which supports the earlier finding, since the supply of education is generally greater in urban communities. Poverty and literacy appear to be closely linked: Moving up one quintile in the poverty distribution increases the likelihood of being literate by 10 percent.

6.2 Determinants of Earnings

The omission of nonworkers from the sample may bias the results if workers' characteristics are different from those of nonworkers. Although we questioned the relevance of the Heckman selection model for developing countries in our discussion of the econometric methodology, following the general-to-specific-approach we first estimate this model as the general model and then investigate whether the selection term may be tested out.

We hypothesized above that the main determinants of earnings are education, age and age squared (proxies for experience), and gender. Regional differences are also likely to exist (because workers from urban areas receive higher average earnings to compensate them for the higher cost of living in urban areas).

It may be that basic literacy rather than education is an important earnings-generating factor in low-income countries. We include (dummy) variables for the highest level of education completed, together with our composite measure of functional literacy. We also introduce interaction terms between the highest level of education completed and functional literacy. Including these terms allows us to investigate whether education serves as a screening device (that is, a signal to employers of potential employees' "quality") rather than as a productivity-enhancing (and thus income-enhancing) factor. If education does not serve as a signal in Ghana, we would expect to see statistically insignificant educational variables, while the composite measure of adult functional literacy and the interaction variables would be statistically significant in the earnings

equation. Finally, we control for sectoral earnings differences by including sectoral dummies.

After the earnings function is sketched, we model the selection equation. Initially, we propose that "family dependence" in a broad sense is likely to affect the labor supply decision. It is not clear a priori in which direction the effect should go. It is possible to argue both that high family dependence induces a higher earnings requirement, which would positively affect labor supply, and that there may be increasing returns to the household from an additional household member, which could negatively affect labor supply. We try to capture this effect by including a variable that indicates whether an individual is married or not.

The other variables from the earnings equation, except the sectoral variables, are relevant for capturing the characteristics of individuals supplying labor. Viewing the selection equation as characterizing the labor supply decision may not be appropriate in developing countries, where limited access to public safety nets implies that labor supply is demand determined. Individuals without access to safety nets will work at any positive wage (their reservation wage will be virtually zero). With this in mind, it seems more intuitive to view possible selection taking place on the demand side. That is, the selection equation quantifies the characteristics of individuals that are sought by prospective employers. Being married, for example, may signal commitment and thus represent a desirable worker characteristic. Because this effect may be different for females and males, we include an interaction term (1 for married women, 0 otherwise).

The results of the estimation of the Heckman selection model of earnings are presented in table 19. The general lack of statistical significance of variables in the earnings equation is striking, and the large dropout of the sample is quite alarming – and implies that the results should be interpreted with caution. In the earnings equation, age and the female and private sector dummy variables are statistically significant at the 1 percent level,

while the marginal returns to middle school graduates and individuals with technical/professional training are statistically significant and positive.

The result suggests the existence of a gender-related earnings gap and seems to indicate that experience is an important earnings-generating factor.[5] The educational variables are generally not statistically significantly different from zero, possibly indicating that the quality of education in Ghana is low, with middle school graduates and technically/professionally trained workers as an exception. The latter may imply that a positive earnings premium is only obtained after a certain level (and since there are only few secondary school and very few university graduates in the sample, the possible earnings premium for the latter may vanish in the sample as a whole). Workers in the private sector obtain earnings that are higher than those of workers in other sectors. The fact that private sector employees obtain higher than average earnings while the premium for public employees is statistically insignificant suggests that workers obtain benefits other than earnings from working in the public sector. These may include increased job security and greater scope for applying one's education.

From the table it is seen that the inverse Mills' ratio is marginally statistically significant. This indicates that sample selection should be taken into account in order to avoid biased estimates in the earnings equation. Moving on to the selection equation, we note that the variables age and Educom1 (which takes a value of 1 when middle school is the highest level of education completed and zero otherwise) are positive and statistically significantly different from zero. Experience and middle school completion thus positively affect the likelihood of working. Completing O/A-levels negatively affects the likelihood of working. This may reflect the fact that students who complete their O/A-levels often put off working in order to continue their education.

Being married and being functionally literate positively affect the likelihood of working for both men and women (the female-married interaction variable is statistically

[5] The gender gap in earnings and the fact that earnings rise (at a decreasing rate) over the life cycle are among the best-established stylized facts of the empirical human capital literature for industrial economies (see Becker 1957, 1975; Blau 1996; Blau and Kahn 1992).

insignificantly different from zero). This result suggests that marriage is an important determinant of labor supply and may indicate that being married signals commitment to a prospective employer. Note that functional literacy works through the selection mechanism rather than directly through earnings, possibly because functional literacy is a prerequisite for entering the labor market.

The monetary returns to skills and education are not statistically significantly different from zero. This result conceals the fact that being functionally literate is a prerequisite for entering the labor market in the first place, however, which is realized when the results of the selection equation are taken into account.

Table 19 Heckman Selection Model of Earnings

Variable	*Coefficient*	*Standard error*	*Z*	*P>|z|*
Earnings equation				
Age	0.675	0.104	6.483	0.000
Age squared	-0.007	0.001	-5.265	0.000
Female	-1.447	0.537	-2.696	0.007
Urban	0.389	1.133	0.343	0.731
Government	0.445	0.448	0.994	0.320
Public	0.723	0.834	0.868	0.385
Private	2.135	0.701	3.047	0.002
Funclit	-1.589	1.132	-1.403	0.160
Educom0	0.404	1.045	0.387	0.699
Educom1	2.737	1.129	2.425	0.015
Educom3	-1.256	0.8674	-1.449	0.147
Educom4	1.248	1.397	0.894	0.372
Educom5	2.803	1.430	1.961	0.050
Educom0*Funclit	0.244	1.439	0.169	0.866
Educom1*Funclit	-0.992	1.540	-0.644	0.520
Educom3*Funclit	3.540	1.556	2.276	0.023
Constant	-3.957	2.293	-1.725	0.084
Selection equation				
Age	0.150	0.039	3.902	0.000
Age squared	-0.002	0.001	-3.566	0.000
Female	0.178	0.208	0.857	0.391
Urban	-0.722	0.325	-2.223	0.026
Educom0	-0.350	0.399	-0.883	0.377
Educom1	6.024	0.468	12.862	0.000
Educom3	19.915			
Educom4	-1.658	0.567	-2.927	0.003
Educom5	19.965			
Educom0*Funclit	-0.467	0.589	-0.794	0.427
Educom1*Funclit	-7.272			
Educom3*Funclit	9.953			
Funclit	1.090	0.511	2.134	0.033
Married	0.882	0.299	2.954	0.003
Female*Married	0.116	0.427	0.271	0.786
Constant	-2.276	0.672	-3.386	0.001
Athrho	-0.587	0.154	-3.799	0.000
Lnsigma	1.297	0.064	20.258	0.000
Rho	-0.528	0.112	-1.776	0.076
Sigma	3.658	0.234		
Mill's lambda	-1.929	0.499		

Note: Number of observations = 345. Censored observations = 268. Uncensored observations = 77. Wald $\chi^2(16) = 308.75$. Prob > $\chi^2 = 0.000$. Log likelihood = -803.1458. Wald test of independent equations (rho = 0): $\chi^2(1) = 14.43$. Prob > $\chi^2 = 0.000$. The sectoral reference category is "other." The educational reference category is "no completed education." Educom2, Educom6, Educom7, Educom2*Funclit, Educom4*Funclit, Educom5*Funclit, Educom6*Funclit and Educom7*Funclit are dropped due to collinearity. *Source*: Ghana Living Standards Survey 1991/92.

7. CONCLUSION

Using two different household surveys on Ghana, we analyze the determinants of literacy and earnings. Our results establish important links between various variables and literacy and earnings.

Age negatively affects the likelihood of being functionally literate, suggesting that literacy has increased over time. This trend may reflect the increased attention toward and supply of education and literacy programs in recent years or improvements in the quality of educational programs that already existed.

A substantial gender gap in literacy exists, with female literacy rates far below those for males. Rural residents are less literate than urban residents, which seems intuitive given the relative scarcity of schools in rural areas. Distance to the nearest primary school negatively affects the likelihood of being literate. These results suggest that supply factors are important determinants of literacy.

Parents' educational level affects the likelihood of their children being literate, with mothers' education having a greater effect than fathers' education. Literacy rates differ across sectors, a reflection of the fact that job requirements vary across sectors. As might be expected, working for the government affects the likelihood of an individual being functionally literate the most, while working for semi-public and private informal enterprises affects it the least. Finally, poorer households tend to be less literate than wealthier households: Moving up one quintile in the income distribution increases the likelihood of being literate by 10 percent.

Our analysis of earnings reveals that income rises with age but at a decreasing rate. Gender also affects earnings, with men earning more than women. Both of these results agrees with the existing empirical evidence in the human capital literature People

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[9] The gender gap in earnings and the fact that earnings rise (at a decreasing rate) over the life cycle are among the best-established stylized facts of the empirical human capital literature for industrial economies (see Becker 1957, 1975; Blau 1996; Blau and Kahn 1992).

employed in the private sector earn more than people employed elsewhere. The premium for public sector employees is not statistically significant, suggesting that public sector employees enjoy other benefits, such as job security or the ability to apply their education, from working in the sector.

The educational variables are generally not statistically significant. This finding may indicate that the quality of education in Ghana is poor. Alternatively, it may suggest that education is not serving as a signaling device in Ghana. Any conclusions about these results should be viewed with caution, however, because of the small number of observations included in the earnings part of the analysis.

The basic earnings equation is extended with a selection equation. The results indicate that being married and being functionally literate positively affect the likelihood of working. Marriage, which is an important determinant of labor supply for both men and women, may signal commitment. Functional literacy works through the selection mechanism rather than directly through earnings. One interpretation, which is in line with our earlier discussion of selection in labor markets in developing economies, is that functional literacy is a prerequisite for entering the labor market. Monetary returns to skills and education are generally not statistically significantly different from zero. Being functionally literate is a prerequisite for entering the labor market in the first place, however, which is realized when the results of the selection equation is taken into account.

The primary policy implication of this study is that greater efforts should be directed at developing functional literacy skills and increasing the quality of education. The focus should be primarily on increasing the supply of basic education and literacy programs, particularly in rural areas. Such programs should target poor households and females, who generally have lower literacy rates than the rest of the population. These conclusions are consistent with the goals and intentions set forth in the Republic of Ghana's development strategy, "Ghana-Vision 2020."

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Appendix. Definition of Variables

Ghana Living Standards Survey (GLSS3)

Age	age (in years)
Age squared	$(Age)^2$
Female	1 if female, 0 otherwise
Urban	1 if living in a urban area (1984 population>5,000), 0 otherwise
Mother's education	continuous variable, 1: primary, 2: middle, etc.
Father's education	continuous variable, 1: primary, 2: middle, etc.
Earnings	the sum of wage income, incomes in kind, housing/transport benefits, etc.,
Earnings quintile	Quintile in the earnings distribution (1-5).
Government	1 if working for the government, 0 otherwise.
Public	1 if working for a public enterprise.
Private	1 if working for a private enterprise.
Funclit	1 if being able to write or read in either English or a Ghanaian language and being able to do written calculations.

Highest level of education attained

Educom00	1 if none, 0 otherwise.
Educom0	1 if primary school, 0 otherwise.
Educom1	1 if middle3 school, 0 otherwise.
Educom2	1 if vocational training, 0 otherwise.
Educom3	1 if teacher training, 0 otherwise.
Educom4	1 if A or O level, 0 otherwise.
Educom5	1 if technical/professional, 0 otherwise.
Educom6	1 if university, 0 otherwise.
Educom7	1 if other, otherwise
Educom0*Funclit	Educom0*Funclit:
Educom1*Funclit	Educom1*Funclit:
Educom2*Funclit	Educom2*Funclit:
Educom3*Funclit	Educom3*Funclit:
Educom4*Funclit	Educom4*Funclit:
Educom5*Funclit	Educom5*Funclit:
Educom6*Funclit	Educom6*Funclit:
Educom7*Funclit	Educom7*Funclit:
Married	1 if married, 0 otherwise.
Female*Married	Female*Married

Core Welfare Indicators Questionnaire (CWIQ)

Age	age
Female	1 if female, 0 otherwise.
Sector variables	
Public	1 if public employee, 0 otherwise.
Private, formal	1 if private formal sector employee, 0 otherwise.
Parastatal/Semi public	1 if parastatal/semi-public sector employee.
Industry variables	
Minerals	1 if working in the minerals industry, 0 otherwise.
Construction	1 if working in construction, 0 otherwise.
Manufacturing	1 if working in manufacturing, 0 otherwise.
Transportation and communication	1 if working in transportation and communication, 0 otherwise.
Wholesale	1 if working in wholesale trade, 0 otherwise.
Retail	1 if working in retail trade, 0 otherwise.
Finance	1 if working in finance, 0 otherwise.
Service	1 if working in services, 0 otherwise.
Other variables	
Distance to school	Distance to nearest primary school (minutes).
Poverty quintile	household wealth quintile